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Wang et al.

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(54) **OPTICAL KEYBOARDS**
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5,034,602 A * 7/1991 Garcia, Jr. H03K 17/968
250/227.22
5,355,148 A * 10/1994 Anderson G06F 1/1616
341/31
5,384,459 A * 1/1995 Patino H01H 13/70
200/314
5,621,207 A * 4/1997 O'Mara G05G 9/047
250/221
6,369,800 B1 * 4/2002 Nading G06F 3/0202
200/314
6,705,783 B1 3/2004 Bowen
7,452,107 B2 * 11/2008 Eckert G05G 9/047
250/221
8,766,920 B2 7/2014 Wang et al.
9,213,416 B2 * 12/2015 Chen H05K 999/99
(Continued)

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,526,775 A * 9/1970 Friedrich H03K 17/941
250/221
4,095,066 A * 6/1978 Harris H01H 21/22
200/458
4,479,111 A 10/1984 Madsen et al.

FOREIGN PATENT DOCUMENTS

GB 2406944 A 4/2005
WO 86/03862 A1 7/1986

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(57) **ABSTRACT**

Aspects of the subject technology relate to electronic devices with input devices. An input device may include a button or a key of a keyboard that uses a light sensor to detect key press events. The light sensor may detect changes in an amount of received light caused by actuation of a keycap of the button or key. The button or key may include an opaque structure that blocks a portion of the light when the key is compressed. The button or key may include a light source such as a light-emitting diode that generates light. A portion of the light from the light source may illuminate the key or button to provide backlight for the key and another portion may be received by the light sensor for detecting partial or complete compression of the button or key.

23 Claims, 11 Drawing Sheets

